

Claims

What is claimed is:

- 1 1. An apparatus, comprising:
2 a unitary layer of electrically non-conductive material having a first surface
3 adjacent a heat sink, a second surface adjacent a heat source, and a plurality of
4 openings communicatively coupled between the first surface and the second
5 surface, wherein a combined area the plurality of openings comprises a selected
6 percentage of the first surface.
- 1 2. The apparatus of claim 1, wherein selected ones of the plurality of openings
2 comprise a regular geometric shape.
- 1 3. The apparatus of claim 2, wherein the regular geometric shape is
2 substantially circular.
- 1 4. The apparatus of claim 2, wherein the regular geometric shape is
2 substantially square.
- 1 5. The apparatus of claim 1, wherein selected ones of the plurality of openings
2 comprise an irregular geometric shape.
- 1 6. The apparatus of claim 1, wherein the combined area of the plurality of
2 openings comprises at least about 90% of the first surface.
- 1 7. The apparatus of claim 1, wherein the combined area of the plurality of
2 openings comprises no more than about 95% of the first surface.

- 1 8. The apparatus of claim 1, wherein the combined area of the plurality of
2 openings comprises a selected percentage of the first surface and the second
3 surface, wherein the selected percentage of the second surface is different
4 from the selected percentage of the first surface.
- 1 9. The apparatus of claim 1, wherein the unitary layer of electrically non-
2 conductive material comprises:
3 a polymer.
- 1 10. The apparatus of claim 1, further comprising:
2 a thermal interface material located between the unitary layer of electrically
3 non-conductive material and the heat sink.
- 1 11. The apparatus of claim 1, wherein the unitary layer of electrically non-
2 conductive material comprises:
3 a non-woven material.
- 1 12. The apparatus of claim 1, wherein the unitary layer of electrically non-
2 conductive material comprises:
3 a plurality of glass beads.
- 1 13. The apparatus of claim 1, further comprising:
2 a thermally conductive material located in selected ones of the plurality of
3 openings, the thermally conductive material selected from at least one of a solid,
4 a liquid, and a paste.
- 1 14. An apparatus, comprising:
2 a heat source;
3 a heat sink; and

4 a unitary layer of electrically non-conductive material having a first surface
5 adjacent the heat sink, a second surface adjacent the heat source, and a plurality
6 of openings communicatively coupled between the first surface and the second
7 surface, wherein a combined area of the plurality of openings comprises a
8 selected percentage of the first surface.

1 15. The apparatus of claim 14, wherein the unitary layer of electrically non-
2 conductive material comprises:
3 a polymer.

1 16. The apparatus of claim 14, wherein the unitary layer of electrically non-
2 conductive material has a substantially uniform thickness of about 0.05 mm.

1 17. The apparatus of claim 14, further comprising:
2 a thermal interface material located between the unitary layer of electrically
3 non-conductive material and the heat source.

1 18. The apparatus of claim 14, wherein the heat source comprises an integrated
2 circuit package including a transponder.

1 19. The apparatus of claim 14, wherein the heat source comprises a die.

1 20. The apparatus of claim 14, wherein the heat sink comprises a heat spreader.

1 21. The apparatus of claim 14, wherein the combined area of the plurality of
2 openings comprises no more than about 90% of the first surface.

1 22. The apparatus of claim 14, wherein the combined area of the plurality of
2 openings comprises no more than about 95% of the first surface.

1 23. A system, comprising:
2 a wireless transceiver;
3 a die including a die surface and a circuit electrically coupled to the wireless
4 transceiver;
5 a heat sink; and
6 a unitary layer of electrically non-conductive material having a first surface
7 adjacent the heat sink, a second surface adjacent the die surface, and a plurality
8 of openings communicatively coupled between the first surface and the second
9 surface, wherein a combined area of the plurality of openings comprises a
10 selected percentage of the first surface.

1 24. The system of claim 23, wherein the wireless transceiver comprises:
2 a transponder.

1 25. The system of claim 23, wherein the unitary layer of electrically non-
2 conductive material comprises:
3 a polymer.

1 26. A method, comprising:
2 coupling a heat sink to a first surface of a unitary layer of electrically non-
3 conductive material; and
4 coupling a heat source to a second surface of the unitary layer of electrically
5 non-conductive material, wherein the unitary layer of electrically non-
6 conductive material has a plurality of openings communicatively coupled
7 between the first surface and the second surface, and wherein a combined area
8 of the plurality of openings comprises a selected percentage of the first surface.

1 27. The method of claim 26, further comprising:
2 applying a thermally conductive material selected from at least one of a
3 solid, a liquid, and a paste to selected ones of the plurality of openings.

1

1 28. The method of claim 26, further comprising:
2 compressing the unitary layer of electrically non-conductive material
3 between the heat sink and the heat source.

1 29. The method of claim 26, wherein the unitary layer of electrically non-
2 conductive material comprises:
3 a polymer.

1 30. The method of claim 26, further comprising:
2 coupling a wireless transceiver to a circuit included in the die.